

WE CLAIM:

1. An integrated circuit having copper interconnecting metallization, a portion of said metallization  
5 exposed to provide a contact pad to said integrated circuit, comprising:
  - one or more layers of conductive barrier metals positioned on said exposed portion of said copper metallization;
  - 10 a bondable metal layer positioned on said barrier layer, said bondable layer having a thickness suitable for wire bonding, and an exposed surface; and
  - a protective overcoat layer surrounding said  
15 bondable layer so that the exposed surface of said bondable layer lies at or below the exposed surface of said overcoat layer.
2. A metal structure for an integrated circuit having copper interconnecting metallization, a portion of said  
20 metallization exposed to provide a contact pad to said integrated circuit, comprising:
  - a conductive barrier layer positioned on said exposed portion of said copper metallization;
  - a plug of bondable metal positioned on said barrier  
25 layer; and
  - a protective overcoat layer surrounding said plug so that the exposed surface of said plug lies at or below the exposed surface of said overcoat layer.
- 30 3. The metal structure according to Claim 2 wherein said overcoat thickness ranges from about 0.6 to 1.5  $\mu\text{m}$ .
4. The metal structure according to Claim 2 wherein said

overcoat layer overlaps between about 0.1 and 0.3  $\mu\text{m}$  over said plug perimeter.

5. The metal structure according to Claim 2 wherein said overcoat comprises one or more layers of silicon  
5 nitride, silicon oxy-nitride, silicon dioxide, silicon carbide, or other moisture-retaining compounds.

6. The metal structure according to Claim 2 wherein said bondable metal plug is aluminum or an aluminum alloy.

7. The metal structure according to Claim 2 wherein said  
10 plug has a thickness between about 0.4 and 1.4  $\mu\text{m}$ .

8. The metal structure according to Claim 2 further comprising a ball bond attached to said plug.

9. The metal structure according to Claim 2 wherein said barrier layer comprises tantalum nitride.

15 10. The metal structure according to Claim 2 wherein said barrier layer is selected from a group consisting of tantalum, titanium, tungsten, molybdenum, chromium, vanadium, alloys thereof, stacks thereof, and chemical compounds thereof.

20 11. The metal structure according to Claim 2 wherein said barrier layer has a thickness between about 0.02 and 0.03  $\mu\text{m}$ .

12. The metal structure according to Claim 2 wherein said barrier layer is patterned to the same area as said  
25 contact pad portion of said metallization.

13. The metal structure according to Claim 2 wherein said plug of bondable metal is patterned to the same area as said contact pad portion of said metallization.

14. The metal structure according to Claim 2 wherein a  
30 portion said overcoat layer overlaps the perimeter of said plug.

15. A wafer-level method of fabricating a metal structure

for a contact pad of an integrated circuit having copper interconnecting metallization, comprising the steps of:

chemically-mechanically polishing said wafer to

5        expose the patterned contact pad areas of said copper metallization embedded in insulating material;

depositing a barrier metal layer over said wafer including said exposed copper metallization;

10       depositing a bondable metal layer over said barrier layer in a thickness sufficient for wire ball bonding;

patterning both said deposited metal layers so that the layer portions outside said contact pad areas are removed and the layer portions over said

15       contact pad areas remain to form a bondable metal plug over each of said contact pads;

depositing a layer of protective overcoat over said wafer, including said metal plugs of said

20       patterned layer portions, said overcoat layer having a thickness so that the exposed surface of said overcoat layer lies at or above the exposed surface of said bondable metal layer;

opening windows in said overcoat layer so that said

25       bondable metal plugs are exposed.

16. The method according to Claim 15 wherein said step of depositing a bondable metal layer includes aluminum in the thickness range from about 0.4 to 1.4  $\mu\text{m}$ .

17. The method according to Claim 15 wherein said overcoat has a thickness in the range from about 0.6 to 1.5  $\mu\text{m}$ .

30       18. The method according to Claim 15 wherein said overcoat frame has a width between about 0.1 to 0.3  $\mu\text{m}$ .

19. The method according to Claim 15 wherein said opening in said overcoat layer leaves a frame of overcoat around the perimeter of each plug.

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